APPENDIX D

MONITORING PLANS

Missouri, like most states, has had limited resources for assessing water quality. For this reason, some waters have been inadequately monitored to determine if they should be 303(d) list candidates. The following is a discussion of how the department intends to address some of these information needs.

The major concerns with waters on this list are discussed below:

I. Streams Affected by Nutrient Enrichment

This category includes streams potentially impaired by nutrient discharges from point sources such as lead mine/mill ponds, large domestic wastewater treatment plant discharges and streams in watersheds which contain large numbers of animals in confined feeding operations. While there are narrative criteria presently in place within the water quality standards which could be used to determine compliance of these waters with state standards, the subjectivenss of these non-numeric criteria make them very difficult to use.

Use of numeric biocriteria now being developed for aquatic macroinvertebrate communities are believed to be a much better approach for defining waters impaired by nutrients and excess algae growth. Development of these biocriteria has been a top priority of the department and has occurred at the fastest pace our resources have allowed. Development of these criteria requires the sampling of hundreds of stream sites statewide at different seasons over a number of years. This biocriteria development program began in 1992 and will be completed in 2001. At that time, the Water Pollution Control Program will propose their placement in our Water Quality Standards regulation. Work so far indicates that these biocriteria will be sensitive to nutrient enrichment of waters and will be a good, objective indicators of impairment due to nutrients and algae.

A biocriteria monitoring program will be instituted to check streams statewide at regular intervals. Streams believed to be impaired by nutrients will be high priority monitoring sites, and those not in compliance with biocriteria will be placed on 303(d) list.

While less definitive in ability to determine nutrient impairment of streams, chemical monitoring has been done on many Missouri streams since the late 1960's and will be continued in the future so that successes, or failures, of nutrient management efforts can be documented. Missouri DNR and the US Geological Survey presently have a cooperative program of fixed station chemical monitoring either 6 or 12 times per year at these 63 sites:

Mississippi R. near Grafton, Ill. (St.Charles Co.)
Missouri R. near St. Joseph
S. Fabius R. near Taylor (Marion Co.)
Nodaway R. near Graham (Nodaway Co.)
Grand R. near Sumner (Chariton Co.)
Fox R. at Wayland (Clark Co.)
Troublesome Cr. near Ewing (Lewis Co.)
Cuivre R. near Troy (Lincoln Co.)
Platte R. at Sharps Station (Platte Co.)
M. FK. Grand R. near Grant City (Worth Co.)

E. Fk. Grand R. near Allendale (Worth Co.)
Weldon R. near Princeton (Mercer Co.)
Locust Cr. near Unionville (Putnam Co.)
Chariton R. near Prairie Hill (Chariton Co.)
Pomme de Terre R. near Polk (Polk Co.)
No Cr. near Dunlap (Grundy Co.)
Lamine R. near Pilot Grove (Cooper Co.)
Niangua R. below Bennett Spring (Dallas Co.)
Roubidoux Spring (Pulaski Co.)
Gasconade R. @ Jerome (Phelps Co.)
Courtois Cr. @ Berryman (Crawford Co.)
Meramec Spring near St. James (Phelps Co.)
Bourbeuse R. @ Union (Franklin Co.)
Meramec R. @ Paulina Hills (St. Louis Co.)
St. Francis R. near Saco (Madison Co.)
Roaring River Spring (Barry Co.)
St. John's Ditch at Hendersons Mound (New Madrid Co.)
Wilson Cr. near Brookline (Greene Co.)
Flat Cr. at Jenkins (Barry Co.)
N. Fk. White R. near Tecumseh (Ozark Co.)
E. Fk. Black R. near Ironton (Reynolds Co.)
Bryant Cr. near Evans (Douglas Co.)
Big Spring (Carter Co.)
L. Black R. below Fairdealing (Butler Co.)
Eleven Point R. near Bardley (Oregon Co.)
South Grand R. (Cass Co.)
Turkey Cr. near Joplin (Jasper Co.)
Thompson R. at Mt. Moriah (Harrison Co.)
Medicine Cr. near Harris (Sullivan Co.)
E. Fk. L. Chariton R. near Huntsville
Elk R. near Tiff City (McDonald Co.)
L. Medicine Cr. near Harris (Mercer Co.)
Mussel Fk. near Mystic (Sullivan Co.)
L. Sac R. near Walnut Grove (Greene Co.)
Osage R. below St. Thomas (Osage Co.)
B. Piney R. @ Devils Elbow (Pulaski Co.)
Huzzah Cr. near Steelville (Crawford Co.)
Meramec R. near Sullivan (Franklin Co.)
Castor R. at Zalma (Bollinger Co.)
Big R. near Richwoods (Jefferson Co.)
Big Cr.@ Baker St. Pk. (Wayne Co.)
Little R. Ditches near Rives (Dunklin Co.)
James R. at Galena (Stone Co.)
James R. @ Boaz (Christian Co.)
Swan Cr. near Swan (Taney Co.)
W. Fk. Black R. at Centerville (Reynolds Co.)
Black R. below Annapolis (Reynolds Co.)
Jacks Fk. @ Two Rivers (Shannon Co.)
Current R. @ Doniphan (Ripley Co.)
Center Cr. near Smithfield (Jasper Co.)
Osage R. near Schell City (Vernon Co.)
Lake Taneycomo (Taney Co.)
Patterson Cr. near Tiff City (McDonald Co.)

Missouri DNR and Crowder College maintain a six station water quality monitoring network in southwestern Missouri on these streams. These sites are monitored monthly.

Elk R. at Tiff City
Indian Cr. near Lanagan
L. Sugar Cr. near Pineville
Buffalo Cr. at Tiff City
Big Sugar Cr. near Powell
Shoal Cr. near Pioneer

DNR plans to increase monitoring in this area by the addition of two sites and increasing monitoring frequency of all 8 sites to 18 times annually in 2000.

In addition, DNR in 2000 initiated quarterly water quality monitoring at these 24 sites:

-Muddy Creek @ Hwy H, Pettis County, NW 18,46N,21W
-Flat Creek @ Hwy 65, Pettis County, just south of Sedalia
-Middle Tebo Creek @ Hwy 2, Henry County, SW 36,44N,25W

-Cole Camp Creek @ Hwy H, Benton County, NW 22,41N,21W
-L. Niangua River at EPA Nutrient Criteria Site
-Honey Creek @ Hwy 6, Grundy County, NENE 24, 61N,24W
-W. Locust Creek @ Hwy 6, Sullivan County, SWSW 25, 62N,21W
-E. Locust Creek @ Hwy 6, Sullivan County, NE 2,62N,20W
-Marrowbone Creek, Daviess County at EPA Nutrient Criteria site
-N. Blackbird Creek @ Hwy 136, Putnam County, SW 2,65N,18W
-Shoal Creek @ Hwy 136, Putnam County, NE 35,66N,17W
-L. Piney Creek at EPA Nutrient Criteria site
-Indian Creek @ Hwy A, Washington County, SW 13,40N1W
-Mineral Fork @ Hwy 47, Washington County, SW Survey 2066
-Mill Creek near Tiff, Washington County, S 13,38N,3E

-Saline Creek @ Hwy Z, Ste. Genevieve County, Survey 2045
-River Aux Vases @ Hwy M, Ste. Genevieve County, Survey 2057
-Hubble Creek just upstream of confluence with Randol Cr., Cape Girardeau County, Survey 674
-Whitewater River @ Bollinger Mill State Park, Cape Girardeau County, 14,31N,11E

-Hahatonka Spring, Camden County
-Bennett Spring, Dallas County
-Tavern Creek @ Hwy 52, Miller County, NENE 27,41N,12W
-Maries River @ Hwy 63 just south of Westphalia, Osage County
-Wet Glaize Creek @ Toronto, Camden County, NE 25,38N,15W

The department will give high priority to collection of additional water chemistry and/or biological monitoring at the following sites:

Bear Creek (Adair County)
Hickory Creek (Daviess County)
Racoon Creek (Grundy Co.)
W. Honey Cr. (Mercer Co.)
Muddy Cr. (Mercer Co.)
Hess-Heath s Cr. (Pettis Co.)
Muddy Cr. (Pettis Co.)
L. Locust Cr. (Putnam Co.)
Sandy Cr. (Putnam Co.)
Shoal Cr. (Putnam Co.)
Stinson Cr. (Callaway Co.)
Hickory Creek (Grundy Co.)
Cave Springs Branch (McDonald Co.)
E. Fk. Long Branch (Sullivan-Linn Co.)
Shoal Creek (entire length, Newton-Barry Co.)
L. Muddy Cr. (Pettis Co.)
Sewer Branch (Pettis Co.)
N. Spring Cr. (Sullivan Co.)
Bee Fork Black River (Reynolds Co.)
Willow Br. (Putnam Co.)

II. Drinking Water Supply Source Waters Potentially Impaired by Herbicides

DNR will continue quarterly raw water monitoring not only of drinking water reservoirs on the 303(d) list due to herbicides, but will also monitor several other reservoirs that are potential 303(d) list candidates due to elevated levels of herbicides. Beginning in 2000 DNR will monitor these 31 reservoirs.

Unionville New Reservoir, Lake Thunderhead, Spring Fork Lake (Pettis County), Breckenridge, Ridgeway Reservoir, Dearborn Reservoir, Harrisonville New Reservoir (SESE Sec,26), Wyaconda Reservoir, La Belle No.1, La Belle No. 2 reservoirs, Monroe City Route J Reservoir, Vandalia Reservoir, Cameron Lower Reservoir, Mark Twain Lake near Clarence Cannon Wholesale Water Commission intake, Smithville Reservoir, Long Branch Reservoir, Schuyler County PWSD No. 1 Reservoir, Marceline Reservoir, Pape (Concordia) Lake and Green City Reservoir, Edina, Baring, Higginsville, Sugar Creek Reservoir (Moberly), Drexel, Butler, Shelbina, Monroe City South, Bucklin, Jamesport and Grindstone Reservoir.

III. McKenzie Creek, Potential Low pH Problems

Additional monitoring of this stream will be done by the department. A total of at least six sampling visits are planned over the next three years and the 303(d) status of this stream should be adequately documented in time for the 2002 303(d) list.

IV. Waters with General Concerns about Habitat Quality

About 1200 stream segments encompassing 40% of the stream miles in the state are believed to suffer some impairment in aquatic habitat quality. To the extent monitoring resources allow, the aquatic macroinvertebrate communities of these streams will be monitored and evaluated by established biocriteria. Streams found not to be meeting biocriteria would then be listed as 303(d) streams.

The department prefers not to list the great majority of these streams as 303(d) waters at this time because although there is compelling evidence for habitat degradation, the evidence is inferred in some cases with little or no actual documentation of a problem in some streams and conflicting evidence in others. More problematical, is that the understanding of how various watershed variables contribute to habitat quality is still not well understood and may frustrate attempts to prescribe watershed treatment programs to improve aquatic habitat.

Because this may be the greatest problem Missouri waters face and because of the present gaps in needed environmental data and in understanding the true nature of the problem and its solution, general aquatic habitat degradation should be the highest priority for future action. The following actions are proposed as a long term strategy:

1. Improve documentation of the existence, extent and nature of aquatic habitat problems by:

    A. Statewide sampling of aquatic macroinvertebrate communities, refinement of biocriteria for macroinvertebrates and refinement of the relationship between invertebrates and habitat. Development and use of a single sampling protocol statewide. Lead agency: MDNR

    B. Development and use of a single fish community sampling protocol statewide:
    Lead agency: MDC.
    Statewide sampling of fish communities using a single collection protocol. Lead agency: MDC

Development of biological criteria for fish communities: Lead agency: MDNR

C. Continue research to refine the relationship between aquatic biota and the many watershed variables that contribute to habitat: Lead agency: MDNR/University of Missouri.

2. Once habitat impaired waters have been well documented by exceedence of biocriteria for invertebrates and/or fish communities, and watershed variables causing impairment have been identified, include these waters on 303(d) list and begin TMDL process.

Items 1A, 1C and the first two items under 1B are already underway. A realistic estimate of the time required to complete the work in item 1 would be at least 15-20 years.